Name _____ Class _____ Date _____

STEM Lab Environmental Engineering

Building a Weather Station

Teacher Notes

TIME REQUIRED one 45-minute class; follow-up observations for 10 minutes per day over ten days

LAB RATINGS

Teacher Prep–1
Student Set-Up–2
Concept Level–3
Clean Up–2

SKILLS ACQUIRED

Collecting Data
Communicating
Designing Experiments
Identifying Patterns
Measuring
Predicting

THE SCIENTIFIC METHOD

In this lab students will

- Ask Questions
- Test the Hypothesis
- Make Observations
- Analyze the Results
- Draw Conclusions
- Communicate the Results

MATERIALS

Cloud charts and simple aneroid barometers can be obtained from science supply houses or local science museums. Cloud charts can also be found on the Internet, through Web sites such as the NASA Web site.

Ideally, each team of 3 students will have their own barometer and cloud chart. If a sufficient number of barometers is not available, then a single classroom "weather station" can be established, with different teams collecting data at different times during the day.

ANSWER KEY

TIPS AND TRICKS

This lab can easily be completed as a homework assignment due to the extended nature of the investigation. You may wish to set up a class weather station and assign groups of students to be responsible for the station for periods of one week throughout the unit, and keep the records over a longer period of time.

Encourage students to carefully plan the data collection form so that they have adequate room to record observations and enter their daily predictions.

If appropriate, students can construct a complete weather station using everyday materials supplemented with some commercial equipment. For example, any container with a flat bottom, such as an empty gallon milk bottle, can be turned into a rain gauge. A pine cone hung from a string will open and close according to relative humidity and can be used as a natural hygrometer. Non-mercury thermometers may already be available in a school supply cabinet. A maximum-minimum thermometer will allow students to obtain daily high and low temperature readings, but it must be reset every day.

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ANSWER KEY

Building a Weather Station

In the past, all a farmer or sailor could do was look at the sky and, based on experience, make a guess about how the weather might change. Until recently, people did not have a clear understanding of how key ingredients of Earth's weather machine—solar heat, Earth's atmosphere, and moisture in the air—interact to shape local weather conditions. Weather forecasts are based on data collected by hundreds of local weather stations. While satellites track weather systems as they develop, you can use relatively simple equipment and weather instruments to observe atmospheric conditions where you live. In this lab, you will build a weather station that helps you learn about tracking weather factors and predicting weather changes based on just two variables, cloud formations and barometric pressure.

OBJECTIVES

Build a weather station using a barometer and cloud chart.

Observe and record weather factors in a data table for ten days.

Predict daily changes in weather based on your data.

MATERIALS

- barometer, aneroid
- box, cardboard, deep, larger than the cloud chart at the base
- cloud chart
- colored markers or pencils
- pencil or pen
- poster board, 22 in × 28 in

SAFETY 

ASK A QUESTION

1. Which is more likely to help form accurate forecasts of changes in weather conditions, a barometer or a cloud chart?

FORM A HYPOTHESIS

2. Form a hypothesis that answers your question. Explain your reasoning.

Answers may vary. Sample answer: Barometers are more likely to help form accurate forecasts of weather changes than cloud charts. Barometer readings can provide information before the formation of clouds: readings indicating falling air pressure predict that clouds may form and precipitation may occur, and rising air pressure indicates clear weather is probable.

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ANSWER KEY

Building a Weather Station *continued*

TEST THE HYPOTHESIS

3. You will be collecting two sets of data at your weather station: cloud type, and barometric pressure. Try to be consistent and take the readings at the same time and from the same place each day. Summarize what data you will collect, where it will be collected, procedures, and the time frame for the investigation. **CAUTION:** Do not take readings during unsafe or severe weather conditions.

Answers may vary. Observations of cloud types and barometric pressure readings will be recorded. The observations will be recorded daily, and conclusions that lead to a prediction of the next day's weather will be made.

4. Using white glue or spray adhesive, attach the cloud chart to a piece of poster board. On the poster board, next to each cloud type, use colored markers or pencils to identify the kind of weather each type of cloud often precedes or indicates. **CAUTION:** When using spray adhesive, wear safety goggles and do not inhale spray fumes. Dispose of empty spray cans properly.

5. Observe clouds each day for ten days. Record your observations in the data table.

6. After you have collected cloud data for two days, complete the "Prediction" column in your table for the next day's weather.

TABLE 1 CLOUD OBSERVATIONS

Day	Cloud Type	Prediction	Actual Weather
Day 1		(observation only)	
Day 2		(observation only)	
Day 3			
Day 4			
Day 5			
Day 6			
Day 7			
Day 8			
Day 9			
Day 10			

7. Research the way an aneroid barometer is used to forecast weather. How is barometric pressure used to predict weather changes?

Falling pressure means storms may be approaching. Rising pressure means that fair or clear weather may be on the way. Stable or static pressure readings mean that the weather is not likely to change.

8. Use the barometer to measure barometric pressure each day for ten days. Record your observations in the data table.

9. After you have collected barometric pressure data for two days, complete the "Prediction" column in your table for the next day's weather.

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ANSWER KEY

TABLE 2 BAROMETRIC PRESSURE

Day	Barometric Pressure	Change (Rising/ Falling/ Stable)	Prediction	Actual Weather
Day 1			(observation only)	
Day 2			(observation only)	
Day 3				
Day 4				
Day 5				
Day 6				
Day 7				
Day 8				
Day 9				
Day 10				

10. Compare your weather predictions based on cloud type and barometric pressure. Which method of forecasting was more accurate?

Answers may vary. Students may notice that for the first few days cloud charts are more accurate in helping to predict fair weather or precipitation, since cloud types indicate weather in the immediate future. Barometer readings over several days will show a trend of rising or falling pressure, and may more accurately predict weather conditions a day or two in the future.

ANALYZE THE RESULTS

1. **Identifying Patterns** Examine your weather data and look for patterns in the data. What kinds of clouds brought precipitation? What relationship do you see between changes in barometric pressure and the weather?

   Answers may vary. Sample answer: Cumulostratus clouds often mean rain is on the way; nimbus clouds bring precipitation. A falling barometer means a storm is coming, and a rising barometric reading brings fair weather.

2. **Evaluating Methods** What were some of the limitations of the barometer used for this lab?

   Answers may vary. Sample answer: The barometer used may not be as accurate as those used by professional weather forecasters and may not have given precise readings. Most barometers must be adjusted for altitude differences compared to sea level—if the adjustment has not been accurately made the readings may not be accurate.

ANSWER KEY

3. **Evaluating Methods** What were some of the limitations of of using the cloud chart in this lab?

   Answers may vary. Sample answer: Although cloud charts can help me accurately identify cloud types, more than one cloud type may be visible at one time. Some cloud types can be difficult to see or hard to identify. Since observations were made once a day at the same time of day, and cloud formations may change during the course of a day, long-term weather prediction using cloud charts was difficult.

DRAW CONCLUSIONS

4. **Evaluating Methods** Review the weather data you collected over the course of the entire lab. Compare your daily weather predictions with the actual weather conditions that were observed the next day. How your predictions could have been improved? Would other instruments have made your predictions more accurate? Explain your reasoning.

   Answers may vary. Students should demonstrate a knowledge of the many factors that play a role in weather, and they should justify their answers regarding additional data-collection tools.

EXTENSION

1. **Applying Conclusions** Obtain weather reports from the newspaper or the Internet for the time period of this lab. How do the weather reports for your local area compare with your data? How do you account for differences?

   Answers may vary. Students should recognize that professional forecasters have many additional sources of information including satellites, Doppler radar, and computer models. Their instruments are also more precise.

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2. **Evaluating Methods** What were some of the limitations of the barometer used for this lab?

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